

PROPOSED METHODOLOGY TO ESTIMATE THE GENERATION RESOURCE MIX OF CALIFORNIA ELECTRICITY IMPORTS

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PROPOSED METHODOLOGY TO ESTIMATE THE GENERATION RESOURCE MIX OF CALIFORNIA ELECTRICITY IMPORTS

Issue

Energy Commission staff proposes to revise the method for estimating the resource mix from out-of-state electricity generated to serve California load. This fuel mix will be used to estimate the associated emissions, including the Greenhouse Gas emissions inventory for California.

This staff paper includes an overview of the western electricity market, electricity import patterns and the staff proposal to estimate the resource mix of electricity imports. The staff proposal is intended to better represent actual system dispatch operations and wholesale market dynamics.

Background

Currently there is no public, western-wide system that identifies the generation source of the electricity imports that are delivered to specific population centers in California. In the past, the Energy Commission staff has estimated this resource mix using simplistic assumptions that allocate the amount of imported electricity to specific fuel types. The annual average power mix in different Western Electricity Coordinating Council (WECC) regions was used to represent the assumed generation source for imports. The resulting resource mix estimates are reported in the Commission's *Net System Power Report*, published annually since 1997.

The Energy Commission requires California control area operators to report the annual amounts of metered electricity flows through the major transmission lines that cross the State line. This represents the amount of electricity imports and exports, but is not specifically linked to transactions. Electricity imports and exports are grouped into two regions, the Pacific Northwest and Desert Southwest. For simplicity, the Energy Commission staff assumed that the annual average power mix in each region was representative of the generation source for imports from each region. This approach was based on the theory that the generation was built to serve California and native load equally.

The staff believes that the averaging methodology overstates the estimated amount of electricity imports from out-of-state baseload generators. Average mix methodology ignores the likelihood that electricity from low-cost baseload power plants owned by out-of-state utilities is primarily dispatched to serve their own local customers.

Baseload generation facilities are typically used to serve the utility's own customers because they are usually the lowest cost resource. The average mix methodology instead assumes that out-of-state generators export a portion of their baseload generation to serve California consumers. Since many of the baseload generation facilities have high Greenhouse Gas emissions, the estimated California emissions inventory is higher than what likely occurs.

Staff believes that the allocation method can be improved to more accurately reflect the sources of electricity bought and sold in each region's wholesale power market. Sufficient information exists to identify the electricity imports coming from generation facilities that are partially owned by California utilities and the amounts associated with firm contracts. However, it will still be necessary to estimate the resource mix of the other electricity imports.

Proposed Method to Estimate the Resource Mix of Electricity Imports

Selecting a methodology requires an understanding of how different generation facilities operate to serve both the short-term and long-term electricity markets. For example, many generating units in the West were built before the 1980s to serve baseload contracts. Baseload units have a lower operating cost, are slow to ramp-up output, and are much more capital-intensive than typical load-following units. Baseload power plant owners generally require a long, steady market for their electricity facilities to operate at the highest efficiency factor and recover investment costs.

This section provides the staff's proposed methodology to better estimate the resource mix of electricity imports. The following sections provide a description of the regional electricity systems and analysis to support the assumptions used for the resource mix methodology.

Firm Power Imports

The methodology proposed for estimating the fuel mix of electricity imports requires identifying all known out-of-state generation ownership shares and contracts. Given greater data availability, the Energy Commission staff is now able to use more detailed accounting methods. Not all of the electricity generation that is associated with known contracts, however, is reported. Some estimates must still be made using different information sources. The identified ownership and contract generation imports are shown in Table 1.

The proposed methodology assumes that all out-of-state generation that is owned by California utilities is used to meet California electricity demand. This approach, however, may still overestimate the amount of actual deliveries to California. Almost

all of California's utilities have a surplus of electricity supply during some times of the year due to the must-take obligations of some contracts. In addition, some municipal utilities currently maintain high planning reserve margins. Furthermore, some in-state generation is needed to support transmission stability, so not all of the out-of-state ownership generation is needed during off-peak periods and is likely sold as surplus electricity on the spot market.

Table 1
2005 Generation from Out-of-State Plants
Owned by California Utilities and Contract Deliveries

California's Shares of Out-of-State Generation			
	2005 Output (GWh)	CA Shares	CA Imports (GWh)
Four Corners (coal)	15,616	33.6%	5,403
Navajo (coal)	17,031	21.2%	3,611
Reid Gardner (coal)	3,933	29.9%	1,176
San Juan (coal)	12,462	24.2%	3,016
Palo Verde (nuclear)	25,807	27.4%	7,074
Out-of-State Generation Reported as Part of California Control Areas that is Considered an Import and Other Contract Deliveries			
	2005 Output (GWh)	Out-of-State Shares	CA Imports (GWh)
Intermountain (coal)	13,664	96.0%	13,118
Mohave (coal)*	10,536	66.0%	6,954
Contracts for Hydroelectricity from SW – Western Area Power Administration			2,093
Boardman contracts (coal)		SDG&E & Turlock	900
Sempra ESP (coal)		29% of Load	1,714

*Mohave closed at the end of 2005 due to air quality permit compliance issues.

Electricity System Purchases

Once ownership shares and contracted imports are determined, that total is subtracted from the reported amount of imports to the California control areas. The result estimates the amount of short-term market purchases. Remaining imports are considered to be system purchases, since electricity is typically traded between many market participants and the actual source is not tracked. System purchases

are assumed to be supplied by surplus electricity generation, typically considered to be marginal generation resources. The marginal generation is estimated separately for the Pacific Northwest (PNW) and Desert Southwest (SW).

Table 2 provides the split between firm generation and system purchase imports. Approximately half of electricity imports in 2005 were firm power deliveries and the rest are considered short-term system purchases.

Table 2
2005 Firm and System Electricity Imports
(GWh)

Imports Type	NW	SW	Total
Firm Imports	1,123	44,159	45,282
System Imports	21,224	21,706	42,930
Total Imports	22,347	65,865	88,212

An Energy Commission staff study identified which generation resources in the Western Electricity Coordinating Council regions are on the margin and typically set market clearing prices. After generation located in California was separated out, the electricity system simulation results showed that natural gas-fired generation is the generation resource that sets the market clearing price 96 percent of the time throughout the rest of the Western region. Coal-fired generation sets the market clearing price 4 percent of the time — almost always during off-peak periods when California has surpluses and does not need to purchase electricity. The staff applied the results of this marginal generation study to the resource mix of the system imports from the SW region.

A similar marginal approach was used for several Electricity Reports that the Energy Commission prepared in the early 1990s to evaluate the availability of surplus generation for wholesale electricity sales to California. Coal-fired generation used to be the marginal generation resource in the SW region during the 1980s and 1990s. Utilities added a number of new coal-fired generation facilities in anticipation of large increases in electricity demand in their service territories. The load growth did not occur as expected and these utilities ended up with a surplus of generation capacity. Increases in electricity demand have since used up the surplus coal-fired generation capacity, but the recent addition of new gas-fired generation has created a new surplus in the region. The marginal generation source will continue to change, depending on what new resources may be added in the future.

Since the PNW system operates differently than the SW system, the staff used a different method to identify the marginal generation resources for the PNW. The model used to simulate the Western electricity system treats hydroelectric generation as a must-run and must-take resource. If this modeling convention were

applied, hydroelectric generation would never be the marginal resource in the PNW. Hydroelectricity from the Columbia and Snake River systems, however, can be the marginal resource when surplus quantities are available in spring and early summer. California utilities, marketers and generators will buy this surplus electricity to serve their customer obligations.

Given that there is a high correlation between PNW water conditions and imports, the staff assumes that 50 percent of the reported imports are from hydroelectric generation. The balance of PNW electricity imports is assumed to be 46 percent from natural gas-fired generation and 4 percent from coal-fired facilities, applying the marginal generation modeling results.

Table 3 provides the resource mix estimates of the PNW and SW system imports for 2005 in gigawatt-hours and percentages.

Table 3
2005 Resource Mix Estimates of Total System Imports
(GWh and Percent)

	NW	Share	SW	Share	Total	Share
System Imports	21,447	100.0%	21,707	100.0%	43,154	100.0%
Coal	858	4.0%	868	4.0%	1,726	4.0%
Hydro	10,723	50.0%	0	0.0%	10,723	24.8%
Natural Gas	9,866	46.0%	20,839	96.0%	30,705	71.2%

Table 4 provides the resource mix estimates for total electricity imports from the PNW and SW. For comparison, Table 5 shows the resource mix using the average generation mix approach that was applied to past Net System Power Reports. The total amount of imports and the resource mix is slightly higher than the *2005 Net System Power Report* since total electricity imports are used instead of net imports. The amount of estimated coal generation imports will likely decline in 2006 since the Mohave Generation Station is now shut down.

Table 6 provides a comparison of the estimated resource mix for in-state generation and the applied methodologies for electricity imports. The proposed methodology shows that coal generation is less than the approach used for past *Net System Power Reports*. The estimated generation from natural gas-fired facilities increases accordingly.

Table 4
2005 Resource Mix Estimates of Total Imports
Using the Proposed Methodology
(GWh and Percent)

	PNW	Share	SW	Share	Total	Share
Total Imports (firm and system)	22,347	100.0%	65,866	100.0%	88,212	100.0%
Coal	1,758	7.9%	35,860	54.4%	37,617	42.6%
Hydro	10,723	48.0%	2,093	3.2%	12,816	14.5%
Natural Gas	9,866	44.1%	20,839	31.6%	30,705	34.8%
Nuclear	0	0.0%	7,074	10.7%	7,074	8.0%

Table 5
2005 Resource Mix Estimates of Total Imports
Using the Average Generation Mix Methodology
(GWh and Percent)

	PNW	Share	SW	Share	Total	Share
Total Imports (firm and system)	22,347	100.0%	65,866	100.0%	88,212	100.0%
Coal	5,426	24.3%	47,028	71.4%	52,454	59.4%
Hydro	14,192	63.5%	1,844	2.8%	16,036	18.2%
Natural Gas	1,967	8.8%	11,724	17.8%	13,691	15.5%
Nuclear	761	3.4%	5,269	8.0%	6,030	6.8%

Table 6
Comparison of the 2005 Total Statewide Resource Mix
Using the Proposed and Average
Estimation Methodologies

Resource Type	Proposed Methodology	Average Methodology
Coal	14.3%	20.1%
Large Hydro	16.3%	17.0%
Natural Gas	43.8%	37.7%
Nuclear	14.9%	14.5%
Renewables	10.7%	10.7%
Total	100.0%	100.0%

The following sections will provide a more detailed description of the WECC generation system to support the assumptions made for estimating the resource mix of electricity imports.

Overview of the Western Electricity Market

During the mid-1960s, expansion of Extra-High Voltage (EHV) transmission line interconnections among electric utility systems in the western states and Canada created the beginnings of a regional system. California utilities, marketers and generators now use the extensive transmission grid to exchange wholesale power and energy from eleven western states, Canada and Mexico, as well as to import power from out-of-state facilities owned by California parties.

The western system transmission grid was gradually built in a piecemeal manner over the last hundred years. The early transmission network was not originally designed to wheel large quantities of power, but to meet the requirements of individual utility systems. Interties between utility systems were developed primarily to ensure system reliability. An interconnection would generally allow power exchanges to supplement and relieve immediate or temporary shortages of capacity. It was not until the last several decades that bulk power transmission lines were proposed and developed in the West to make use of regional diversity opportunities and generation surpluses.

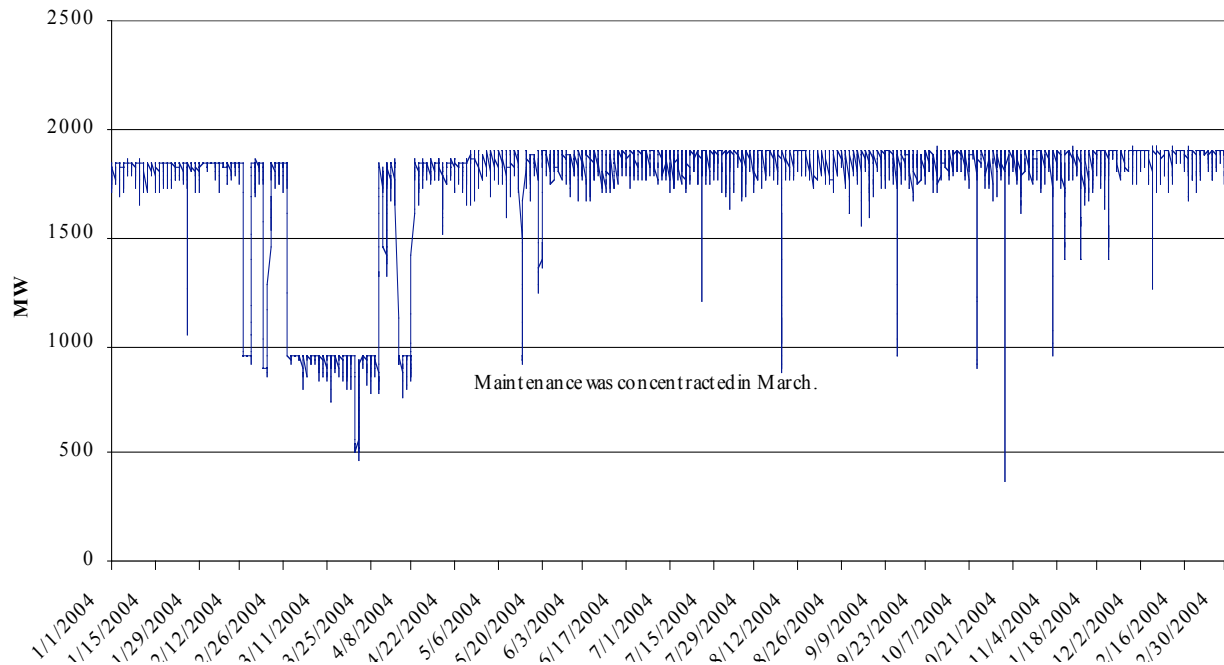
The interconnected, inter-dependent wholesale power market now provides reliability benefits and broad opportunities for cost savings due to a diverse mix of surplus electricity resources and different load patterns in each region. All in all, between one-quarter to one-third of California's electricity loads are supplied from out-of-state wholesale power transactions and utility-owned generation.

Electricity is imported from other western states for various reasons using different types of transactions. Electricity is imported from ownership shares of generating plants located in other states and owned by California utilities, long-term contracts and unlabelled "system purchases". There are also wheeling transactions where electricity is bought and sold among out-of-state market participants which use the transmission lines that cut through California for deliveries.

Out-of-State Ownership Generation and Contracts

The generation from out-of-state ownership shares and from contracts are generally used to meet Load Serving Entity (LSE) customer loads. The generation sources are typically baseload facilities that operate at high capacity factors and do not vary significantly day-to-day. Figure 1 illustrates the operating profiles of a typical generation facility that is owned in part by California utilities.

Figure 1
Hourly Generation from Intermountain
(2004)



Ownership shares and generation from out-of-state facilities is well documented. Table 7 provides the ownership shares of the generation from seven baseload generation facilities, all located in the Desert Southwest Region. The total generation owned by California utilities declined by 1,387 MW with the closure of the Mohave Generation Station at the end of 2005.

Table 8 provides the generation from the ownership facilities between 2001 and 2005. This table shows that the amount of electricity generated from the out-of-state ownership facilities does not vary significantly from year to year.

San Diego Gas and Electric Company and the Turlock Irrigation District both have a long-term contract with the coal-fired Boardman facility located in Oregon. A number of California utilities also have entitlement shares for generation from Hoover Dam located in the Desert Southwest. Sempra also reports that approximately 29 percent of their Energy Service Provider customer demand is served by coal generation.

Table 7
California Utility Ownership Shares
Of Generation Facilities Located Out-of-State
(Dependable Capacity MW)

Facility Name	Dependable Capacity (MW)	Ownership Shares	
		Percent	MW
Intermountain	1,810	96.0%	1,738
Mohave	1,387	66.0%	915
Four Corners	2,140	34.6%	740
Navajo	2,250	21.2%	477
Reid Gardner	595	29.9%	178
San Juan	1,647	24.2%	399
Palo Verde	3,867	27.4%	1,060
Total	13,696		5,507

Table 8
Generation from California Utility Ownership Shares
(Gigawatt hours per year)

Facility Name	2001	2002	2003	2004	2005
Intermountain	12,855	12,947	13,020	13,852	13,118
Mohave	6,766	6,712	6,401	6,715	6,954
Four Corners	5,211	4,468	5,425	5,171	5,403
Navajo	3,686	3,780	3,461	3,757	3,611
Reid Gardner	1,147	1,253	1,226	1,215	1,176
San Juan	2,863	3,000	2,743	3,024	3,016
Palo Verde	7,873	8,459	7,832	7,706	7,074
Total Generation	40,402	40,620	40,107	41,439	40,351

Short-term Market Transactions

The rest of the electricity imports are generally short-term transactions that are traded on the Western wholesale power market. These types of transactions are usually traded each hour and can be resold to marketers a number of times before actual delivery takes place, making the actual generation source difficult to track. For this reason, the electricity is generally described as system purchases.

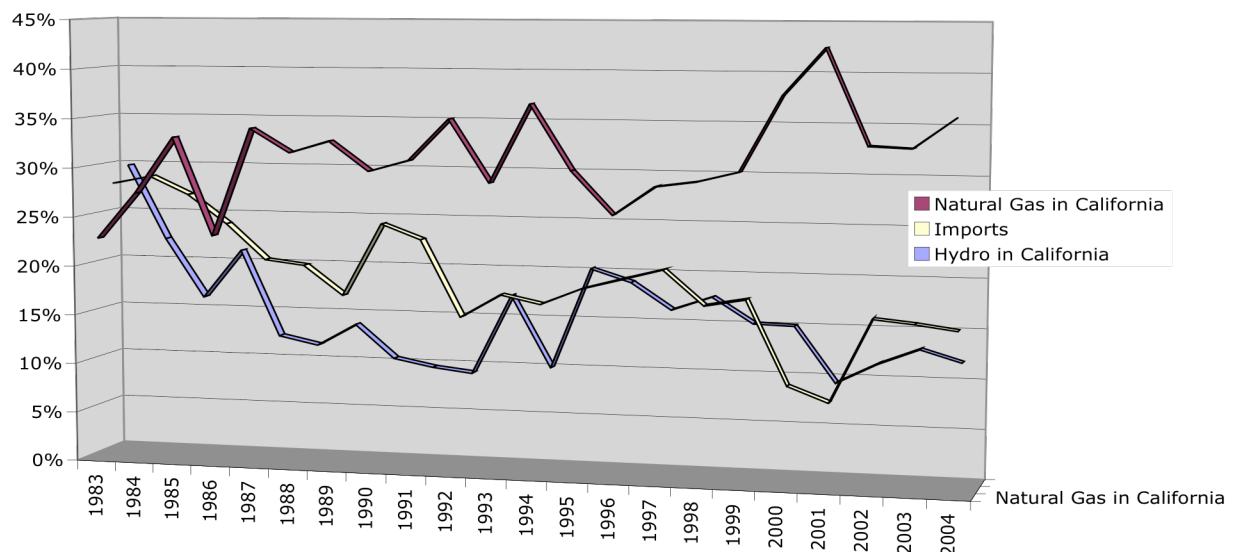
California LSEs, marketers and generators occasionally purchase this electricity to meet unexpected supply shortfalls due to higher-than-expected demand or facility outages. Energy Service Providers (ESP) also purchase electricity to meet their customer demand. Other than the coal generation reference that one ESP reported, these entities indicated that the electricity supplies are from system purchases.

Most of the electricity serving short-term transactions comes from surplus generation capacity which varies day to day and year to year. Generators with surplus capacity will usually try to sell electricity on the spot market when prices are favorable. Typically, short-term electricity prices are lower than the decremental cost of a generator and higher than the sellers' incremental costs.

Purchases of short-term electricity from out-of-state suppliers will thereby allow in-state generators to reduce costs by displacing generation from their higher cost facilities. LSEs can also use this market to hedge financial and physical risks, and to lower the cost of serving load. Figure 2 shows that natural gas generation in California changes in response to the amount of hydroelectric generation available within the State and the amount of low-cost system imports. The imports in the figure do not include the generation from ownership shares located out-of-state or the amount of electricity associated with long-term contracts.

Figure 2

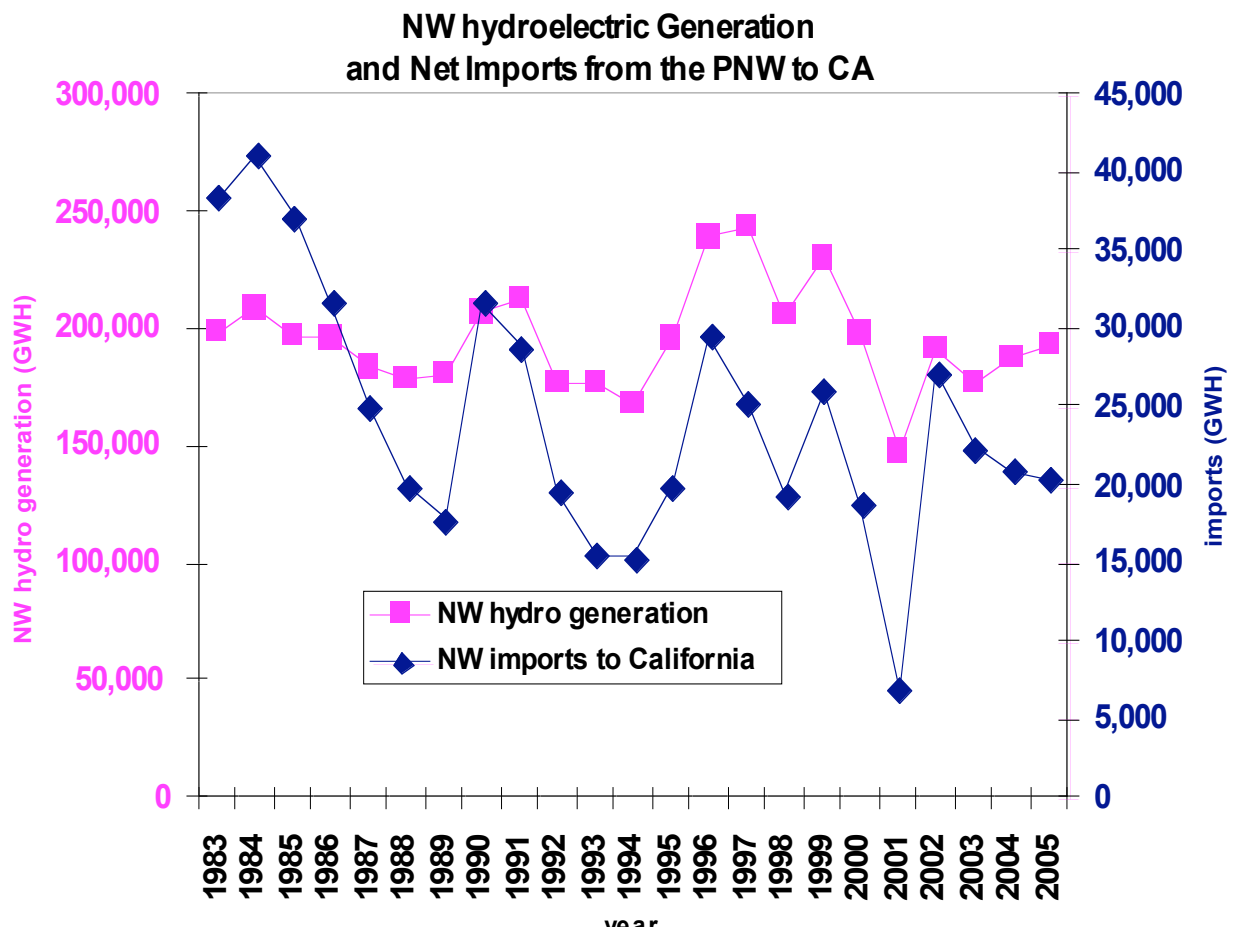
**Percent of California Load Met by Various Resources
1983-2004**



Competition exists when many market participants vie for the use of existing low cost surpluses, especially if their own marginal costs are high. Surplus power from the PNW region generally comes from Columbia River hydroelectric facilities. Generation capacity has been over-built in other states in the West, based upon the assumption that local load needs would continue to rapidly increase or to take advantage of expected high market prices.

Figure 3 shows that there is a correlation to the amount of hydroelectric generation in the PNW and net electricity imports (imports – exports) from that region. The large decline in net imports during 2001 is due to lower imports and a large amount of reported exports, which is a similar observation for SW exports (see Appendix A for reported imports and exports). The decline is due in part to low water conditions in the PNW, but also due to peculiar market behaviors observed during the 2000-01 energy crisis.

Figure 3

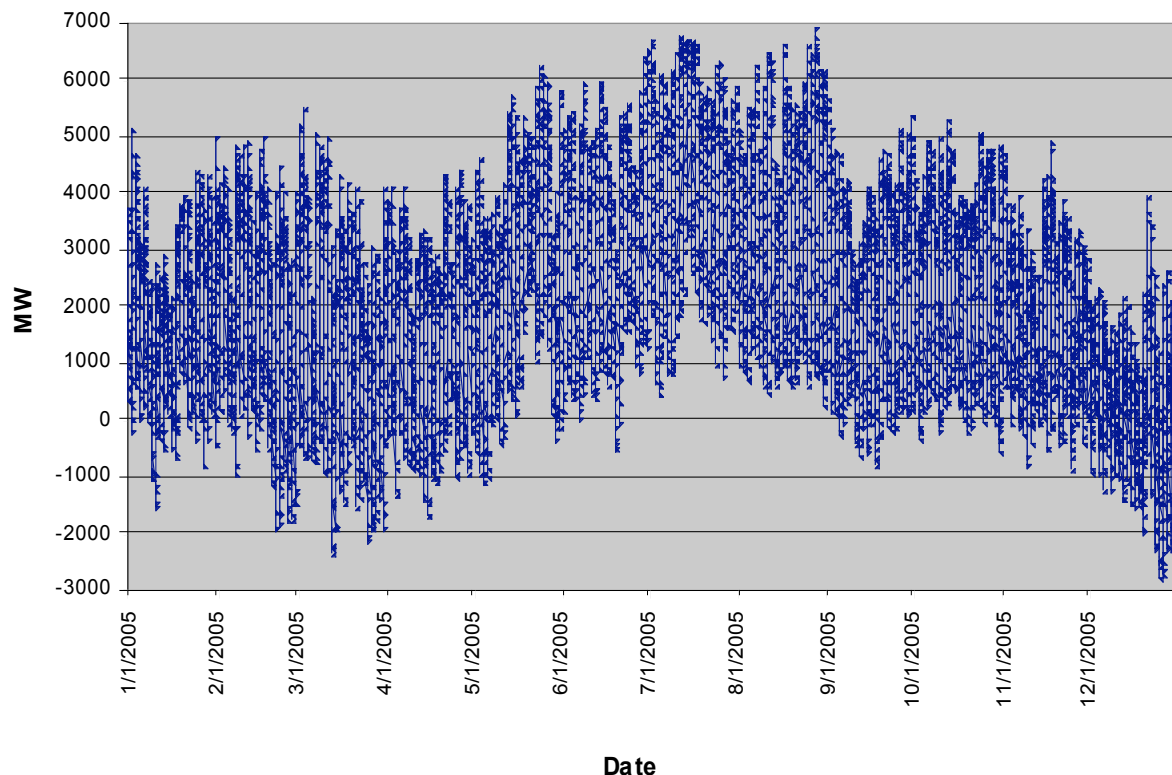


Much of the electricity delivered from the PNW to California should be traceable to changes in generation at the many hydroelectric facilities in the region. However, the Energy Commission staff was unable to obtain hourly hydroelectric generation data from power stations in the PNW. However, Figure 4 does show the hourly energy flows between the PNW and California to illustrate the typical profile of these imports and exports. PNW imports will typically occur during the day and drop off during the evening. The figure also shows exports, represented in the negative values.

The Energy Commission staff does not have hourly transmission flows for electricity metered at the SW injection points. Approximately 65 percent of the SW imports are identified as electricity from ownership generation and contracts, which are typically delivered from baseload facilities. These generators typically operate 24 hours a day with minor changes in the evening output. The remainder of the SW imports is assumed to be short-term system purchases generated from surplus capacity and operated when there is a market for this electricity.

Figure 4

2005 CA-PNW Hourly Intertie Flows



Source: Bonneville Power Administration

Surplus Generation Capacity

WECC periodically assesses its reliability, in part, by determining the summer reserve margins of its four regions and of the WECC region as a whole. The reserve margin measures the available capacity in excess of the capacity needed to meet normal peak demand. Regions with high reserve margins have a higher level of reliability than those with low reserve margins because they have more resources to mitigate any contingencies that may occur.

The latest WECC reliability assessment, completed in June 2005, projects a summer 2006 reserve margin of 29.8 percent for the WECC area¹. In addition, some WECC regions have even higher projected summer reserve margins. For example, the Northwest Power Pool region, which is a region that frequently exports power to the California-Mexico region, is projected to have a reserve margin of 48 percent. Table 9 provides the 2004 reserve margins reported by WECC and the projected surplus for 2006 and 2008.

Resource additions in the Desert Southwest region of the WECC from 1990 through 2005 were primarily natural gas-fired combined-cycle power plants. Of the nearly 23,000 MW of dependable capacity added during those years, over 21,000 MW is fueled by natural gas. Wind generators accounted for almost 900 MW of capacity from 1990 through 2005 while 550 MW of coal-fired generation capacity was installed during that time frame. As shown in Figure 5, the majority of the resource additions occurred since 2000, with plant development from regulated utilities such as APS, and merchant generators.

While the PNW region added fewer resources than the SW from 1990 to 2005, those additions were also dominated by gas-fired power plants. Nearly 80 percent of the 14,500+ MW of new capacity installed in the region is gas-fired (11,200 MW), while coal-fired generation accounted for nearly 12 percent of the additions (1,721 MW). More than 1,000 MW of wind capacity was installed in the NW region during those years. Similar to the SW region, Figure 6 shows that the bulk of capacity additions were installed since 2000, developed by both regulated utilities and for-profit wholesale electricity providers.

¹ "10-Year Coordinated Plan Summary." Western Electric Coordinating Council (2005): 31-54.

Table 9
Historical 2004 Reserve Margin and
Projected Reserve Margins for 2006 and 2008

	<u>2004</u>	<u>2006</u>	<u>2008</u>
WECC			
Load	139,169	147,411	155,326
Generation	179,603	191,270	201,518
Reserve Margin	29.1%	29.8%	29.7%
Region I - Northwest Power Pool Area			
Load	50,903	51,489	54,047
Generation	75,026	76,204	83,234
Reserve Margin	47.4%	48.0%	54.0%
Region II - Rocky Mountain Power Area			
Load	10,222	11,001	11,575
Generation	12,229	12,704	13,341
Reserve Margin	19.6%	15.5%	15.3%
Region III - Arizona-New Mexico-Southern Nevada Power Area			
Load	25,415	27,626	29,451
Generation	34,112	36,248	37,929
Reserve Margin	34.2%	31.2%	28.8%
Region IV - California-Mexico Power Area			
Load	54,565	57,392	60,253
Generation	58,418	65,854	69,209
Reserve Margin	7.1%	14.7%	14.9%

Figure 5
Southwest Capacity Additions
by Fuel Type

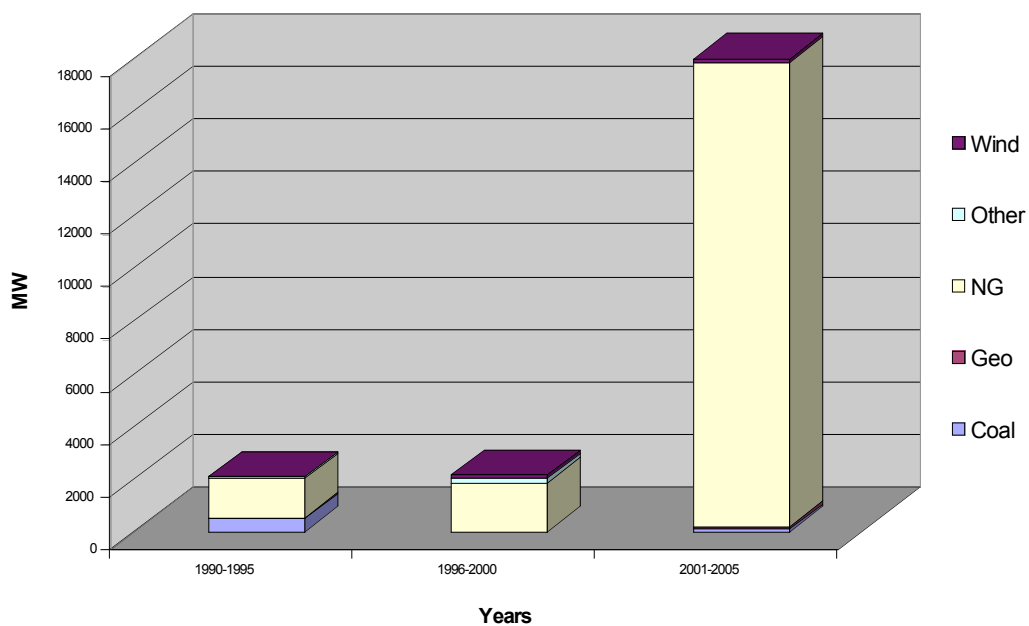
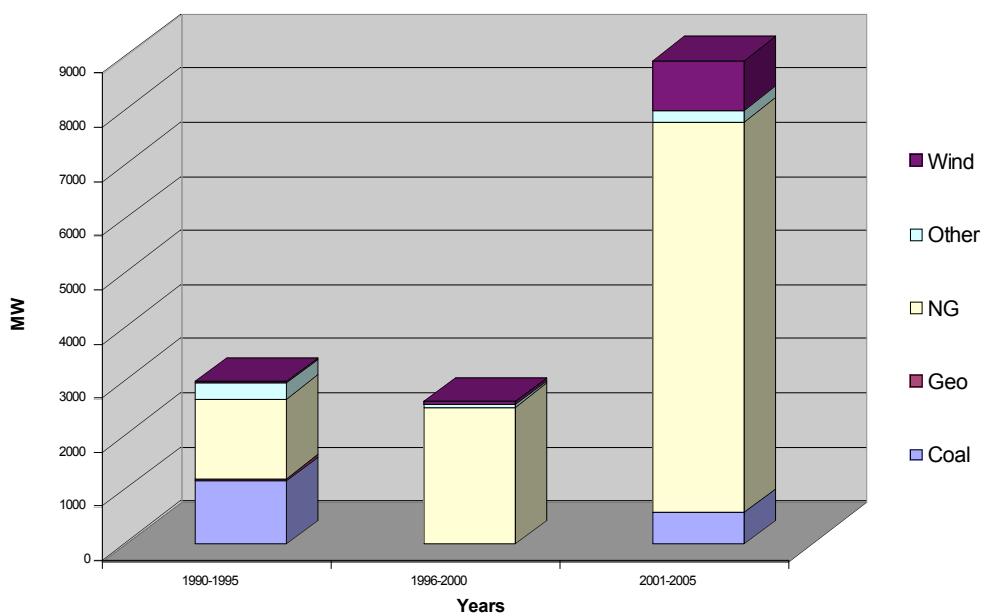


Figure 6
Northwest Capacity Additions
by Fuel Type



Marginal Generation in WECC Regions

The Energy Commission's Electricity Analysis Office conducted an electricity system simulation study, using the MarketSym model currently licensed, to evaluate the generation resources that are on the margin each hour of the year. The purpose of the study was to identify the generation resources that are likely used for spot market transactions, a significant portion of the California imports.

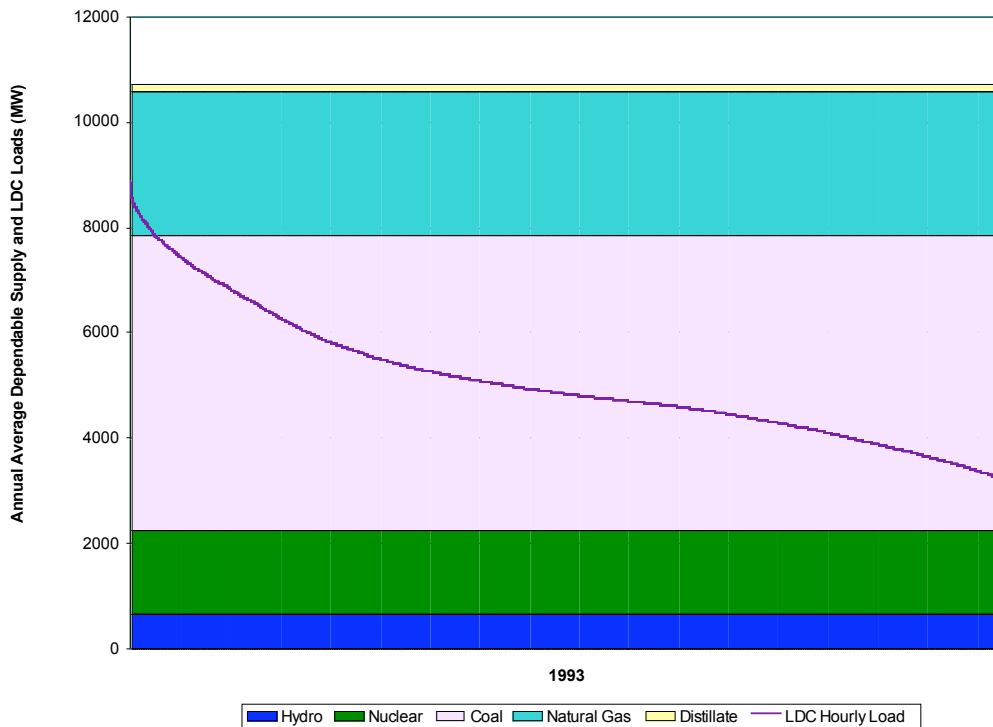
The modeling runs were conducted for 2008, using the California demand forecast from the Commission's 2005 *Integrated Energy Policy Report* along with the compiled forecasts for the rest of the WECC region. New resources that are currently under development and known retirements are also included. This dataset was shared with WECC members for comment and may ultimately be used for regional transmission studies.

After subtracting out the California generation, the simulation results indicate which resources are on the margin and will set the market clearing prices during the different hours of the day throughout 2008. Natural gas generation sets the market clearing price most of the time (96 percent). Generation that is fueled by coal sets the market clearing price 4 percent of the time — almost always in off-peak periods when California does not need to purchase energy. This result is the basis for the proposed assumption that natural gas-fired generation is the primary source of Desert Southwest spot purchases.

Natural gas-fired generation was not always considered the marginal resource in the SW. Energy Commission studies that were conducted in the early 1990s demonstrated that the SW region had a significant surplus of coal-fired generation capacity. The SW utilities overbuilt their generation system anticipating a large growth in electricity demand, which did not occur. Consequently, the utilities with surplus generation capacity sold electricity on the spot market at reduced prices.

Figure 7 illustrates the potential amount of surplus generation capacity in 1993 compared to the actual recorded load duration curve in Arizona. Arizona is used as an example since it is centrally located in the Southwest region and linked with transmission lines to California and other WECC regions. The load duration curve represents the different levels of hourly demand on the electricity system, sorted by decreasing size. The amount of generation illustrated in Figure 7 represents the average dependable capacity of the facilities located in Arizona, adjusted by annual average maintenance and forced outages estimates. We do not have the actual hourly generation to develop a true load duration curve. The generation is sorted according to the typical costs to produce electricity, with gas-fired generation costing more than other resources. This figure shows that there was a significant amount of excess coal-fired generation in the state in 1993, as seen in the potential electricity that can be generated above the load duration curve.

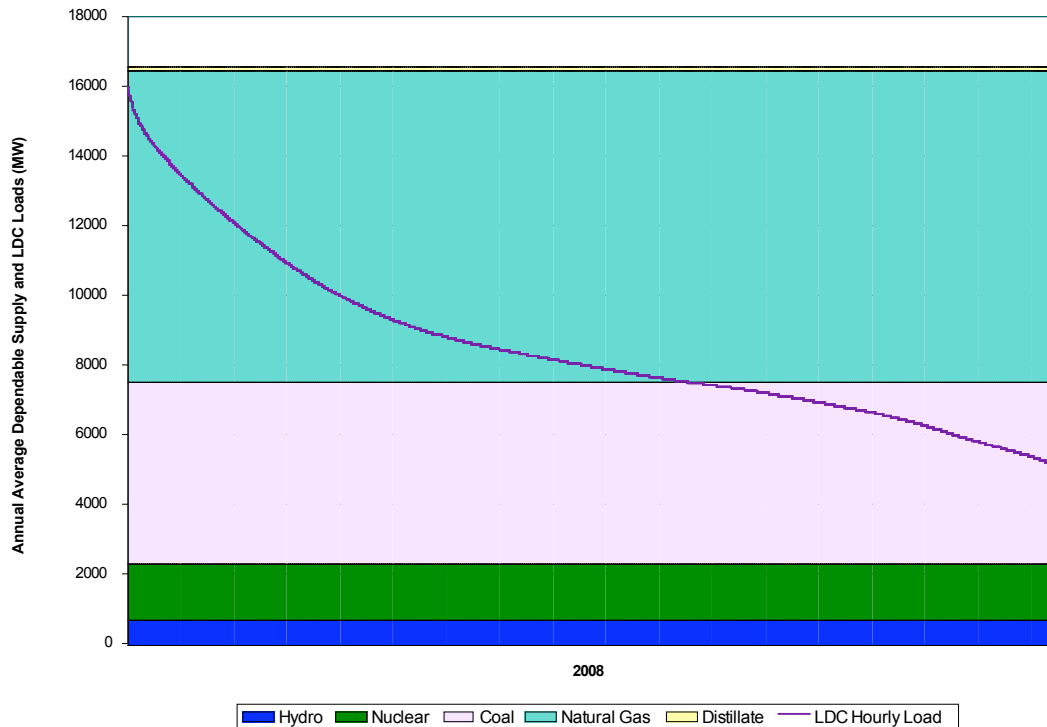
Figure 7
Arizona 1993 LDC Load and Supply



Electricity demand has almost doubled in the Southwest since the early 1990s, using much of the surplus coal-fired generation capacity. Utilities will typically use the cheaper generation from these facilities to satisfy their own customer electricity demand, which is generally reflected in the ratepayer electricity bills. Utilities will then use the next lowest cost resource that is available if needed and will sell the remaining amounts of electricity if there is a willing buyer.

Figure 8 is the estimated load duration curve for Arizona in 2008, using projected electricity demand hourly profiles and average dependable generation capacity of existing and likely to be completed projects. Similar to Figure 7, the generation type is sorted according to production costs. This figure illustrates that most of the coal-fired capacity is likely to be used for Arizona electricity demand and that natural gas-fired generation capacity is the resource now on the margin. The potential coal-fired generation that is above the load duration curve occurs during most evenings and weekends when electricity demand is low in both Arizona and California.

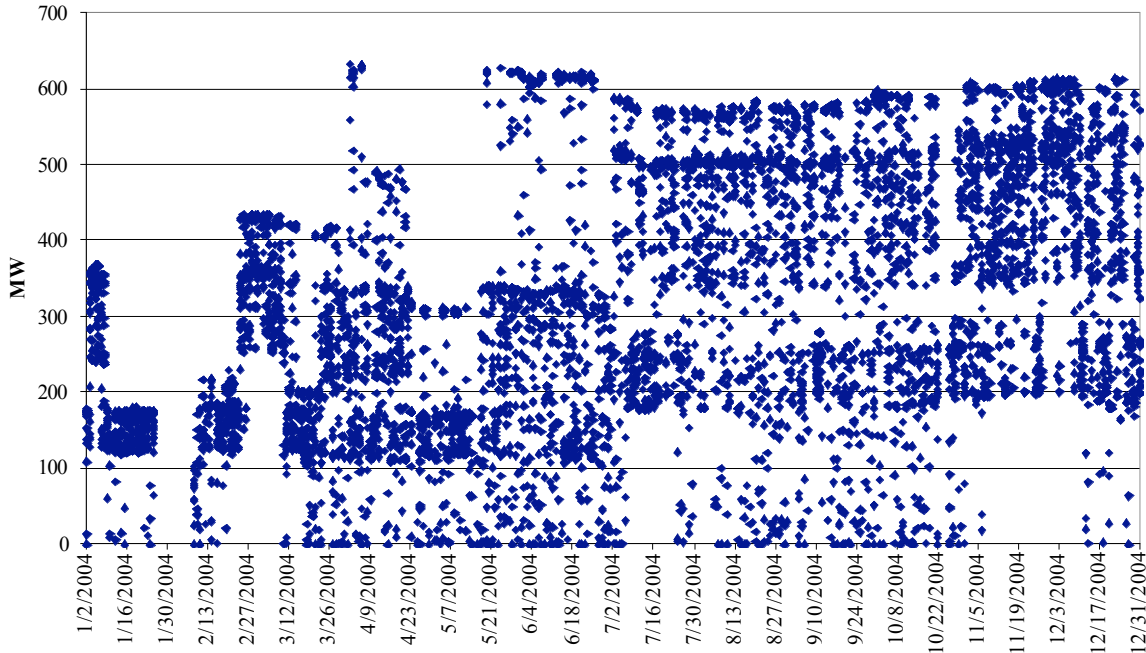
Figure 8
Arizona 2008 LDC Loads and Supply



Many of the natural gas-fired generation facilities available in WECC operate at varying capacity factors, ramping up to varying generation levels throughout the day. Figure 9 shows the 2004 hourly generation pattern for one of the newer combined-cycle generation facilities in Arizona. Generation will vary depending on local demand, and any opportunities that are available to sell into the short-term market to recover some of the owner's investment costs. Although this particular facility is operating at high capacity factors during different times of the year, there are many gas-fired facilities operating at lower levels. The average capacity factor for all natural-gas facilities located in the PNW and SW is about 24 percent (total generation divided by total nameplate capacity).

Figure 9

**2004 Hourly Output of Desert Basin
CC, Arizona**



Conclusion

Staff believes that quantifying the sources of firm power imports and estimating the resource mix of short-term electricity purchases is a more accurate approach than the averaging methodology that has been used for previous Commission reports.

Given the above mentioned historical observations and modeling simulations, staff believes that it is reasonable to assume that natural gas-fired generation is the primary resource serving the short-term electricity market in the Southwest. Hydroelectric generation is the primary resource providing Pacific Northwest system exports to California with natural gas representing most of the balance. Coal generation serves 4 percent of the short-term California imports from both regions.

The future mix of the electricity imports will depend on the types of long-term contracts that California LSEs procure and what different generation technologies are developed throughout WECC that may become the new marginal resource at the time.

If the proposed methodology is adopted by the Commission, staff will then apply the estimates to calculate the associated green-house gas emissions.

APPENDIX A – REPORTED IMPORTS AND EXPORTS

(Does not include Generation from Mohave or Intermountain)

Region	Year	Q1	Q2	Q3	Q4	Annual total
PNW	2001	2,686,806	2,925,793	3,164,629	3,895,215	12,672,443
	2002	4,902,982	9,340,960	8,894,501	5,068,055	28,206,498
	2003	4,900,088	7,717,723	6,382,322	4,774,696	23,774,829
	2004	4,231,046	6,284,849	5,599,096	6,247 ,893	22,362,884
	2005	4,592,016	6,062,609	7,593,342	4,098,955	22,346,922
SW	2001	11,498,217	12,842,356	8,382,562	10,225,639	42,948,774
	2002	10,690,112	9,130,572	9,271,389	12,704,560	41,796,634
	2003	11,892,989	9,597,592	10,832,254	11,739,573	44,062,40 8
	2004	12,434,004	11,294,721	12,424,582	12,586,469	48,739,776
	2005	11,822,051	9,443,747	11,644,778	12,883,050	45,793,626
Export (MWh)						
Region	Year	Q1	Q2	Q3	Q4	Annual total
PNW	2001	3,050,938	1,450,178	922,009	423,084	5,846,209
	2002	283,492	132 ,236	342,790	261,888	1,020,406
	2003	417,812	183,635	389,592	480,346	1,471,385
	2004	377,742	292,647	563,791	297,969	1,532,149
	2005	594,995	330,898	528,497	606,848	2,061,238
SW	2001	494,698	4,999,585	2,394,086	1,119,003	9,007,372
	2002	816,964	1,471, 143	2,455,830	769,629	5,513,566
	2003	827,810	1,401,653	1,462,198	863,046	4,554,707
	2004	975,464	813,515	934,717	568,728	3,292,424
	2005	593,309	1,371,982	1,277,594	380,408	3,623,293
Net Import (MWh)						
Region	Year	Q1	Q2	Q3	Q4	Annual total
PNW	200 1	-364,132	1,475,615	2,242,620	3,472,131	6,826,234
	2002	4,619,490	9,208,724	8,551,711	4,806,167	27,186,092
	2003	4,482,276	7,534,088	5,992,730	4,294,350	22,303,444
	2004	3,853,304	5,992,202	5,035,305	5,949,924	20,830,735
	2005	3,997,021	5,731,711	7,06 4,845	3,492,107	20,285,684
SW	2001	11,003,519	7,842,771	5,988,476	9,106,636	33,941,402
	2002	9,873,148	7,659,429	6,815,560	11,934,931	36,283,067
	2003	11,065,179	8,195,939	9,370,056	10,876,527	39,507,701
	2004	11,458,540	10,481,206	11,489,865	12,017,74 1	45,447,352
	2005	11,228,742	8,071,765	10,367,184	12,502,642	42,170,333